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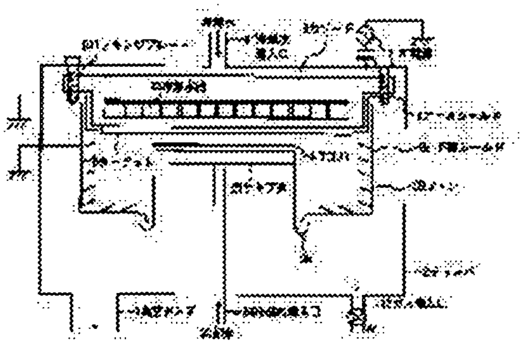
(54) SPUTTER FILM FORMING DEVICE AND SPUTTER FILM FORMING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the change of the compsn. of a wafer film at the time of sputtering.

SOLUTION: This device is composed of a target 6 provided in a chamber 2, a susceptor 21 provided opposite to the target 6 in the chamber 2 and to be mounted with a wafer deposited with sputtering particles sputtered from the target 6 and shields 8, 9a and 9b provided for preventing the arrival of the sputtering particles to the inner wall of the chamber 2 and arranged so as to be far from the distance with the wafer 4 on a view from the target 6 in the region opposite to the target 6, and the normals on the surfaces of the shields 8, 9a and 9b are formed not so as to face to the circumferential part of the wafer 4.



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CLAIMS

[Claim(s)]
[Claim 1] The target electrode with which it is prepared in a vacuum housing and a target is arranged, The susceptor which lays the wafer which the sputtered particles by which countered with said target electrode, and were prepared in said vacuum housing, and the spatter was carried out from said target deposit, Spatter membrane formation equipment characterized by coming to provide shielding arranged so that it may be prepared that it should prevent, said sputtered particles may be seen reach said vacuum housing wall from said target in said target and the field which counters and it may become far rather than the distance to said wafer.
[Claim 2] The target electrode with which it is prepared in a vacuum housing and a target is arranged, The susceptor which lays the wafer which the sputtered particles by which countered with said target electrode, and were prepared in said vacuum housing, and the spatter was carried out from said target deposit, It is spatter membrane formation equipment characterized by coming to provide shielding prepared that it should prevent that said sputtered particles reach said vacuum housing wall, and being formed and the normal of the front face of said shielding becoming so that the wafer periphery section laid in said susceptor may not be turned to.
[Claim 3] Spatter membrane formation equipment according to claim 1 or 2 characterized by preparing the cooler style which cools said wafer in said susceptor.
[Claim 4] In the spatter membrane formation approach which deposits on said wafer the sputtered particles which seceded from said target by the spatter by the inert gas accelerated between the wafers which countered the target electrode and this target electrode with which a target is arranged, and were prepared within the vacuum housing Shielding which divides the space between the wall front face of said vacuum housing and said target arrangement side front face of said target electrode with said wafer is prepared in said vacuum housing that it should prevent that said sputtered particles reach said vacuum housing wall. In said target and the field which counters, said shielding See from said target and it arranges in the distance rather than the distance to said wafer. And the spatter membrane formation approach characterized by performing a spatter so that said sputtered particles which it is made not to turn to said wafer periphery section, adhered to this shielding, and seceded from the normal of the front face of said shielding may not adhere to a wafer.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the spatter membrane formation equipment and the spatter membrane formation approach of performing especially homogeneous high membrane formation with respect to spatter membrane formation equipment and the spatter membrane formation approach.
[0002]
[Description of the Prior Art] Uniform membraneous quality and thickness are obtained in a large area, and the spatter which is one of the PVD(s) (Physical Vapor Deposition) is excellent also in a thickness controllability, and has spread widely as formation techniques, such as wiring of a semiconductor device, by the predominance, like incidence particle energy is also high. Moreover, the impact of the inactive ion generated by discharge is carried out to the high-melting matter, and since it is the approach of making evaporate the matter high-melting [this] and making it form, it is mostly used also to creation of an insulating thin film.
[0003] Conventionally, high dielectrics and ferroelectrics, such as BST (Ba, Sr) (TiO3) and PZT (Pb(Zr, Ti) O3), are formed by the sol-gel method and the above-mentioned spatter. In forming membranes by the spatter, it carries out the spatter of the target which sintered BST and PZT by Ar gas from the point of productivity. Moreover, since BST and PZT are insulators, generally RF (Radio Frequency) spatter is used.
[0004] The configuration in [whole] the chamber of the conventional sputtering system is shown in drawing 2 . As shown in drawing 2 , a cathode 3 and the wafer 4 to which the target matter is made to adhere are laid in the interior of a chamber (vacuum housing) 2 in which the exhaust air system which consists of a vacuum pump 1 was prepared. A cathode 3 consists of a target 6 stuck on the back up plate 5 and the back up plate 5. RF power is supplied to this back up plate 5 by the RF power source 7.
[0005] Generally, near target 6 front face is covered with shielding in order to prevent adhesion of the film in chamber 2 wall. In drawing 2 , the case where the ground shielding 8, the lower shielding 9, and the up shielding 10 are arranged as shielding is shown, and each is grounded through the chamber 2.
[0006] Since target 6 front face serves as an elevated temperature at the time of a spatter, cooling water is introduced from the cooling water inlet 11, and it circulates through target 6 rear face. Thereby, a target 6 is maintained by predetermined temperature and it prevents that target 6 the very thing fuses. Moreover, a magnet 12 is formed in the cathode 3 interior. The electron generated by discharge between a wafer 4 and a target 6 with this magnet 12 is made to rotate by the field. And spatter vacuum evaporationo is made to accelerate by raising the plasma consistency near target 6 front face, and making the frequency of a ionization collision high.
[0007] The plasma is generated between a cathode 3 and a wafer 4 according to the RF power source 7. During this plasma discharge, the auto-bias produced on target 6 front face accelerates, and Ar ion introduced from the gas inlet 12 carries out the spatter of the matter which constitutes a target 6. The sputtered particles generated from the target 6 by the spatter are deposited on a wafer 4 and shielding 8, 9, and 10. It is accelerated at the sheath potential produced to wafer 4 front face or shielding 8, 9, and

10, and some Ar ion carries out the impact of wafer 4 front face or the shielding 8, 9, and 10, and carries out the re-spatter of the film adhering to the front face to the deposition and coincidence to these shielding 8, 9, and 10. Moreover, the temperature of a wafer 4 or shielding 8, 9, and 10 also rises by this ion bombardment.

[0008] Here, when PZT is used as target matter, since [that vapor pressure is very high and] the effectiveness of a spatter yield, i.e., a spatter, is high as compared with other Zr, Ti, etc., Pb which is a configuration element in PZT is very difficult to control the amount of re-spatters, and the amount of reevaporation. That is, since Pb with high spatter yield and vapor pressure is preferentially etched by heating of the re-spatter by Ar ion, a wafer 4, and shielding 8, 9, and 10 (reevaporation), the presentation of the film deposited on the wafer 4 will be changed. For example, when there are many re-spatters in shielding 8, 9, and 10, in order that Pb by which the re-spatter was carried out may carry out wafer 4 HE adhesion from shielding 8, 9, and 10, Pb presentation in wafer 4 film will increase.

[0009] In order to influence [big] wafer 4 periphery by shielding 8, 9, and 10 by the geometry of a wafer 4 and shielding 8, 9, and 10 furthermore as compared with wafer 4 center section, it will have distribution of a presentation in radial [of a wafer 4]. Thus, a target presentation and the film presentation on a wafer 4 are difficult to control in order to be influenced from shielding 8, 9, and 10.

[0010]

[Problem(s) to be Solved by the Invention] As explained above, the spatter yield which constitutes other target matter from a spatter using conventional spatter membrane formation equipment by the film adhering to a wafer or shielding especially a spatter yield, and the target matter with high vapor pressure re-evaporating, or carrying out a re-spatter with inactive ion, and the ratio which adheres to a wafer as compared with the low configuration element of vapor pressure become high, and the presentation of the film which adhered to the wafer by this changes.

[0011] The place which it was made in order that this invention might solve the above-mentioned technical problem, and is made into the purpose is to offer the spatter membrane formation equipment which prevents change of a film presentation in the wafer film, and the spatter membrane formation approach.

[0012]

[Means for Solving the Problem] The spatter membrane formation equipment concerning claim 1 of this invention The target electrode with which it is prepared in a vacuum housing and a target is arranged, The susceptor which lays the wafer which the sputtered particles by which countered with said target electrode, and were prepared in said vacuum housing, and the spatter was carried out from said target deposit, It is characterized by coming to provide shielding arranged so that it may be prepared that it should prevent, said sputtered particles may be seen reach said vacuum housing wall from said target electrode in said target and the field which counters and it may become far rather than the distance to said wafer.

[0013] Moreover, the spatter membrane formation equipment concerning claim 2 of this invention The susceptor which lays the target electrode prepared in the vacuum housing, and the wafer which the sputtered particles by which countered with said target electrode, and were prepared in said vacuum housing, and the spatter was carried out from this target electrode deposit, It is characterized by coming to provide shielding prepared that it should prevent that said sputtered particles reach said vacuum housing wall, and being formed and the normal of the front face of said shielding becoming so that the wafer periphery section laid in said susceptor may not be turned to.

[0014] The desirable gestalt of this invention is shown below.

(1) Two or more fins are prepared in the front face of shielding, and the normal of the front face of these fins is formed so that the wafer periphery section laid in the susceptor may not be turned to.

(2) Shielding consists of the outer cylinder section in which duplex cylinder structure was prepared in same axle to nothing, the inner cylinder section, and an inner cylinder, and a pars basilaris ossis occipitalis of the shape of a circular ring established so that one end face of an inner cylinder and an outer cylinder might be connected.

In (3) and (2), the direction of a normal of a sputtered-particles adhesion side is adjusted by preparing a

fin in a shielding front face.
(4) Spatter membrane formation equipment is single wafer processing.
(5) A target is an insulator.
(6) A target is a high dielectric or a ferroelectric.
(7) Pb or Bi is included in a target.
(8) RF power is used for spatter membrane formation equipment.
(9) Spatter membrane formation equipment is the superposition spatter of DC power and RF power.
(10) The cooler style which cools a wafer is prepared in the susceptor.
(11) A susceptor consists of a cooled electrostatic chuck pedestal.
The cooler style of the wafer of (12) and (10) is performed by carrying out the chuck of the wafer to the cooled electrostatic chuck pedestal.

[0015] Moreover, the spatter membrane formation approach concerning claim 4 of this invention In the spatter membrane formation approach which deposits on said wafer the sputtered particles which seceded from said target by the spatter by the inert gas accelerated between the wafers which countered the target electrode and this target electrode with which a target is arranged, and were prepared within the vacuum housing Shielding which divides the space between the wall front face of said vacuum housing and said target arrangement side front face of said target electrode with said wafer is prepared in said vacuum housing that it should prevent that said sputtered particles reach said vacuum housing wall. In said target and the field which counters, said shielding It is characterized by performing a spatter so that said sputtered particles which saw from said target, have arranged in the distance rather than the distance to said wafer, and it is made not to turn to said wafer periphery section, adhered to this shielding, and seceded from the normal of the front face of said shielding may not adhere to a wafer.

[0016] (Operation) In the spatter membrane formation equipment with which the target electrode and the wafer countered, since reevaporation or the target matter by which the re-spatter was carried out stops being able to fly to a wafer easily from shielding by arranging shielding so that it may become near from the distance of a wafer and shielding about the distance of a target electrode and a wafer, this invention does not affect it to the film presentation deposited on the wafer. That is, the film deposited on a wafer becomes a thing only from a target, and becomes settled uniquely in the presentation of the target matter.

[0017] Moreover, when making it the normal on the front face of shielding not turn to the wafer periphery section, the particle which the re-spatter was carried out from the shielding front face, or was re-evaporated is seen from a wafer, without going on in the direction of a wafer, and is emitted in the direction of a vacuum housing wall. Therefore, sputtered particles do not carry out redeposition to a wafer, fluctuation of a wafer presentation is lost, and the homogeneity within a field also improves.

[0018]
[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained, referring to a drawing. Drawing 1 is the cross-sectional view showing the whole spatter membrane formation equipment configuration concerning 1 operation gestalt of this invention. As shown in drawing 1 , the susceptor 21 which lays a cathode 3 and a wafer 4 in the interior of a chamber (vacuum housing) 2 in which the gas inlet 12 which introduces inert gas, such as an exhaust air system, Ar ion, etc. which consist of a vacuum pump 1, was established counters, and is arranged. A cathode 3 consists of a target 6 stuck on the back up plate 5 and the back up plate 5. Moreover, the target 6 which its cooling effectiveness was high since the back up plate 5 was constituted by the thermally conductive matter with high Cu etc., and was stuck on this back up plate 5 can be cooled easily. 13.56MHz RF power is supplied to this back up plate 5 by the RF power source 7.

[0019] Moreover, it applies to the periphery section of a target 6 from the periphery section of a susceptor 21, and Shielding 8, 9a, and 9b is formed. The front face of a target 6 and predetermined spacing are set, and these shielding 8, 9a, and 9b is formed, prevents that sputtered particles adhere to the wall of a chamber 2, and is constituted by stainless steel members, such as SUS, so that the space between the wall front face of a chamber 2 and target 6 front face may be divided with a wafer 4. In drawing 1 , it consists of ground shielding 8 and lower shielding 9a and 9b, and the advance to chamber

2 wall of the particle which floats without adhering to a wafer 4 among the sputtered particles by which the spatter was carried out from the target 6 with these three shielding is intercepted completely. Moreover, Shielding 8, 9a, and 9b is grounded through the chamber 2, and the wafer susceptor 21 is also grounded. these shielding 8, 9a, and 9b -- membrane formation conditions -- floating (un-grounding) -- even if -- it is good.

[0020] It is prepared in the flank of the back up plate 5 from the periphery section of a target 6, covering the ground shielding 8 so that near front faces other than target 6 may be covered among back-up-plate 5 front faces. It prevents that the inert gas accelerated by the plasma carries out the spatter of the back up plate 5 by this.

[0021] Lower shielding 9a consists of level fields, i.e., a target 6 and the field which counters, to a perpendicular field and a wafer 4 to a wafer 4. To a wafer 4, a perpendicular field separates from the edge of a wafer 4 about 150mm, and is arranged. Moreover, since it is the field which as for a level field there are most sputtered particles to a wafer 4, and adheres, it is caudad arranged about 10mm from the location of the wafer 4 at the time of membrane formation, and becomes the structure covered by this from the flank of the back up plate 5 to directly under [of a wafer 4 / periphery section]. Thus, the physical relationship with the wafer 4 of lower shielding 9a to which a lot of sputtered particles adhere especially is located in the place which looked at from the target 6 and was left as compared with the distance to a wafer 4.

[0022] Moreover, it applies even directly under [the] the periphery section from the 4 round edge of wafers, and lower shielding 9b which had a perpendicular field to the wafer 4 is prepared. It is fixed to the susceptor 21 and this lower shielding 9b moves up and down with a susceptor 21. Moreover, these lower shielding 9b overlaps lower shielding 9a and directly under the 4 round edge of wafers at the time of a spatter. Therefore, the course of sputtered particles can be intercepted with both [these] the shielding 9a and 9b.

[0023] Moreover, two or more fins 22 are formed in a lower shielding 9a front face. This fin 22 is constituted by stainless steel members, such as the same quality of the material as Shielding 8, 9a, and 9b, i.e., SUS etc. Moreover, the installation include angle is adjusted so that the normal of fin 22 front face may not turn to the 4 round edge of wafers, and fin 22 front face is seen from a wafer 4, and turns to the direction of chamber 2 wall.

[0024] The taking-out close to the chamber 2 of a wafer 4 is made by the wafer susceptor 21. That is, a susceptor 21 carries out rise-and-fall migration along the vertical direction, and performs the exchange of the transfer robot from a conveyance room, and a wafer 4 which is not illustrated. A wafer 4 is located in the place distant from target 6 front face 30mm when the susceptor 21 which laid the wafer 4 goes up at the time of membrane formation.

[0025] The cooling water which the cooling water inlet 11 was established in the cathode 3, and was introduced from the cooling water inlet 11 in the back up plate 5 is introduced, and the cooling water way 23 which circulates the whole surface of target 6 rear face is formed in this cooling water. Since target 6 front face serves as an elevated temperature at the time of a spatter, a target 6 is maintained by predetermined temperature by this cooling water way 23, and it can prevent melting of target 6 the very thing.

[0026] Moreover, the cooling water inlet 24 is formed and the electrostatic chuck by which water cooling was carried out with the cooling water introduced from this cooling water inlet 24 is used for the wafer susceptor 21 in order to prevent the temperature rise of the wafer 4 by the generated plasma. The temperature control of the high sensitivity of a wafer 4 becomes possible by this electrostatic chuck. Moreover, in order that not only temperature control but the susceptor 21 may adsorb a wafer 4 by electrostatic induction, the membrane formation of it to the wafer 4 whole surface is attained, and the service area of membrane formation increases it. Moreover, generating of the particle from the chuck section can be prevented.

[0027] Next, actuation of the spatter membrane formation equipment concerning this operation gestalt is explained. As shown in drawing 1, RF power is impressed to the target 6 which is cathode according to the RF power source 7. With this RF power, the plasma occurs between the wafers 4 which are a target 6 and an anode plate. It is accelerated by the plasma and the impact of the inert gas, such as Ar ion introduced from the gas inlet 12 between these two electrodes, is carried out to the target 6 put on the cathode side. By this impact, the great portion of sputtered particles which jumped out of target 6 front face are deposited on the wafer 4 which counters a target 6. Moreover, the sputtered particles which do not advance to a wafer 4 pass through the gap of a wafer 4 and a target 6, diffuse it in a longitudinal direction, reach Shielding 8, 9a, and 9b, and are deposited on the front face.

[0028] For example, when the high element of a spatter yield and an element with high vapor pressure are contained in the configuration element of the deposit deposited on Shielding 8, 9a, and 9b, using PZT as target matter (here explains using Pb in PZT), The re-spatter especially of the Pb in the PZT film deposited on lower shielding 9a is preferentially carried out by inert gas, or it is re-evaporated preferentially, and the amount's [this amount of re-spatters and] of reevaporation increases as compared with Zr and Ti which are other configuration elements.

[0029] For this reason, although Pb which the re-spatter was carried out from Shielding 8, 9a, and 9b in addition to PZT which comes flying from a target 6 on a wafer 4, or was re-evaporated comes flying, since the distance of a wafer 4 and Shielding 8, 9a, and 9b is greatly separated as compared with the distance of a wafer 4 and a target 6, a wafer 4 is not influenced from Shielding 8, 9a, and 9b. Therefore, the film presentation of a wafer 4 is in agreement with the presentation of the target matter.

[0030] Moreover, since the particle by which the re-spatter was carried out from the shielding 9a front face by forming the fin 22 is emitted to the method of outside so that a surface normal may not turn [front face / lower shielding 9a] to the 4 round edge of wafers, redeposition is not carried out to a wafer 4. Therefore, fluctuation of a presentation of a wafer 4 is lost.

[0031] It can prevent that the great portion of Pb re-evaporated from Shielding 8, 9a, and 9b by these flies to a wafer 4, and the film presentation on a wafer 4 is in agreement with a target presentation.

[0032] Next, the example which formed the PZT film which is ferroelectric film is explained, actually using the spatter membrane formation equipment concerning this operation gestalt. Further, Ti lays the wafer 4 with which 175nm spatter membrane formation of the Pt was carried out on it in the susceptor 21 which is a lower electrode, and introduces 20nm into it in a chamber 2. After introducing a wafer 4, 6.6Pa of Ar gas is introduced for the inside of a chamber 2 from vacuum suction and its blasting-fumes inlet 12 up to 5x10 to 6 Pa with a vacuum pump 1.

[0033] Subsequently, 1.5kW high-frequency power is impressed to a target 6 from the RF power source 7, RF plasma is generated, the spatter of the target 6 which consists of PZT is carried out with Ar ion, and the PZT film is formed on a wafer 4. In order to suppress the temperature rise of a wafer 4 and a target 6 at this time, water cooling of the cooling water was introduced and carried out to the target 6 and the wafer susceptor 21 from the cooling water inlets 11 and 24.

[0034] When ICP-MS (Inductively Coupled Plasma Mass Spectrometry: inductive-coupling RF plasma mass) analysis of the presentation of the wafer after membrane formation was carried out, in the wafer side, uniform mole-ratio Pb/(Zr+Ti) =1.1 were obtained and this mole ratio became almost the same as the presentation of a target 6. When membrane formation was continued on two or more wafers 4, the temperature of Shielding 8, 9a, and 9b rose gradually, but since it was prepared in the location distant from the wafer 4, the effect by the reevaporation or the re-spatter of Pb from Shielding 8, 9a, and 9b was not seen.

[0035] Thus, since the distance between a wafer 4 and a target 6 is shorter than distance with Shielding 8, 9a, and 9b, the great portion of sputtered particles by which spatter emission was carried out from the target 6 accumulate on a wafer 4. Since Shielding 8, 9a, and 9b is separated from the wafer 4 and a re-spatter and the re-evaporated target matter cannot reach a wafer 4 from Shielding 8, 9a, and 9b, as for the film which grows up to be a wafer 4, the presentation of the target matter itself is imprinted. Thereby, the film on a wafer 4 is uniquely determined, when the presentation of the target matter becomes settled.

[0036] Moreover, when the RF power source 7 is used as an acceleration power source, big effectiveness is especially done so. That is, since there are many amounts of spatters to the wafer 4 of Ar ion, there are many sputtered particles which secede from a target 6, and it is because it deposits also to

Shielding 8, 9a, and 9b mostly. In order for a re-spatter and the target matter by which reevaporation is carried out not to jump out of a lower shielding 9a front face in the wafer 4 direction since the fin 22 is formed so that it may see from a wafer 4 and a surface normal may turn to an outside, but to go in the direction of chamber 2 wall, it stops moreover, adhering to a lower shielding 9a front face on a wafer 4.

[0037] Furthermore, since contiguity arrangement is carried out, the temperature of a wafer 4 rises, but since water cooling of the susceptor 21 is carried out with cooling water, a wafer 4 and a target 6 can prevent the temperature rise of a wafer 4. Moreover, in order to use an electrostatic chuck as a cooler style, the temperature control of high sensitivity becomes possible.

[0038] In addition, although the insulating PZT target was used in the above-mentioned operation gestalt, you may not be an insulating material, and the oxygen in a target 6 may be reduced and the target 6 which raised conductivity may be used. In this case, a spatter can be carried out with the power which DC power and RF power superimposed, and it becomes possible to make a membrane formation rate high.

[0039] Moreover, although the case where RF power source was used as an acceleration power source was shown, even if it is an acceleration power source only by the superposition spatter of not only when only RF power source is used, but a DC power supply and RF power source, and the DC power supply, it does not deviate from the main point of this invention. Moreover, it is applicable also to the magnetron sputtering method by arranging a magnet to the cathode 3 interior. Moreover, a batch type is also applicable although the case where a spatter was carried out to single wafer processing by the susceptor 21 was shown.

[0040] Moreover, although the case where the direction where the target matter which two or more fins 22 were formed in lower shielding 9a, and the re-spatter was carried out, or was re-evaporated runs was controlled was shown, it is also controllable by not turning the normal of the front face of the lower shielding 9a itself to the 4 round edge of wafers. That is, in this case, to the inside, the front face of the horizontal plane of lower shielding 9a turns an outside front face down, and is leaned, and the front face of a vertical plane is arranged so that it may spread as it goes to the lower part and may be leaned. Moreover, although the case where are arranged so that lower shielding 9b may also make a perpendicular to a wafer 4, and the normal of a shielding 9b front face made horizontally was shown, it can also arrange so that the normal which does not need to arrange such, for example, came out from the lower shielding 9b front face may incline caudad. In this case, lower shielding 9b is leaned so that it may narrow as it goes to the lower part. Moreover, a fin 22 can also be formed also in lower shielding 9b. Furthermore, although the case where the target 6 of shielding 9a and the field which counters were arranged so that it may become further from a target 6 than a wafer 4 was shown, of course, the effectiveness of this invention is done so by forming a fin 22 for the same arrangement as the former very much, without arranging such.

[0041] Moreover, although shielding showed the configuration which consists of ground shielding 8 and lower shielding 9a and 9b, the ground shielding 8 and lower shielding 9a may unify that what is necessary is just what can intercept the course of the sputtered particles which advance in addition to the wafer 4 direction. Moreover, although the case where a wafer 4 was fixed by the electrostatic chuck was shown, you may fix also by the mechanical chuck.

[0042]

[Effect of the Invention] Since the distance from a wafer is far according to this invention even when the re-spatter of the target matter deposited on shielding by carrying out near of the target inter-electrode distance to a wafer rather than the distance of a wafer and shielding is carried out by the reevaporation and the ion bombardment by heat as explained above, a wafer cannot be reached. Therefore, since the film which grows up to be a wafer becomes only the matter emitted directly from a target, the target presentation itself is imprinted and a deposition film presentation can prevent change of a film presentation of a wafer.

[0043] Moreover, the particle which the normal of the front face of shielding became the structure where the adhesion side of sputtered particles faced outside to a wafer since it is formed so that the wafer periphery section laid in the susceptor may not be turned to, and the re-spatter was carried out among the particles adhering to an adhesion side, or was re-evaporated is not emitted in the direction of a wafer. Thereby, the effect of the re-spatter from shielding and reevaporation can be lost.

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the spatter membrane formation equipment and the spatter membrane formation approach of performing especially homogeneous high membrane formation with respect to spatter membrane formation equipment and the spatter membrane formation approach.

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PRIOR ART

[Description of the Prior Art] Uniform membraneous quality and thickness are obtained in a large area, and the spatter which is one of the PVD(s) (Physical Vapor Deposition) is excellent also in a thickness controllability, and has spread widely as formation techniques, such as wiring of a semiconductor device, by the predominance, like incidence particle energy is also high. Moreover, the impact of the inactive ion generated by discharge is carried out to the high-melting matter, and since it is the approach of making evaporate the matter high-melting [this] and making it form, it is mostly used also to creation of an insulating thin film.
[0003] Conventionally, high dielectrics and ferroelectrics, such as BST (Ba, Sr) (TiO3) and PZT (Pb(Zr, Ti) O3), are formed by the sol-gel method and the above-mentioned spatter. In forming membranes by the spatter, it carries out the spatter of the target which sintered BST and PZT by Ar gas from the point of productivity. Moreover, since BST and PZT are insulators, generally RF (Radio Frequency) spatter is used.
[0004] The configuration in [whole] the chamber of the conventional sputtering system is shown in drawing 2 . As shown in drawing 2 , a cathode 3 and the wafer 4 to which the target matter is made to adhere are laid in the interior of a chamber (vacuum housing) 2 in which the exhaust air system which consists of a vacuum pump 1 was prepared. A cathode 3 consists of a target 6 stuck on the back up plate 5 and the back up plate 5. RF power is supplied to this back up plate 5 by the RF power source 7.
[0005] Generally, near target 6 front face is covered with shielding in order to prevent adhesion of the film in chamber 2 wall. In drawing 2 , the case where the ground shielding 8, the lower shielding 9, and the up shielding 10 are arranged as shielding is shown, and each is grounded through the chamber 2.
[0006] Since target 6 front face serves as an elevated temperature at the time of a spatter, cooling water is introduced from the cooling water inlet 11, and it circulates through target 6 rear face. Thereby, a target 6 is maintained by predetermined temperature and it prevents that target 6 the very thing fuses. Moreover, a magnet 12 is formed in the cathode 3 interior. The electron generated by discharge between a wafer 4 and a target 6 with this magnet 12 is made to rotate by the field. And spatter vacuum evaporationo is made to accelerate by raising the plasma consistency near target 6 front face, and making the frequency of a ionization collision high.
[0007] The plasma is generated between a cathode 3 and a wafer 4 according to the RF power source 7. During this plasma discharge, the auto-bias produced on target 6 front face accelerates, and Ar ion introduced from the gas inlet 12 carries out the spatter of the matter which constitutes a target 6. The sputtered particles generated from the target 6 by the spatter are deposited on a wafer 4 and shielding 8, 9, and 10. It is accelerated at the sheath potential produced to wafer 4 front face or shielding 8, 9, and 10, and some Ar ion carries out the impact of wafer 4 front face or the shielding 8, 9, and 10, and carries out the re-spatter of the film adhering to the front face to the deposition and coincidence to these shielding 8, 9, and 10. Moreover, the temperature of a wafer 4 or shielding 8, 9, and 10 also rises by this ion bombardment.
[0008] Here, when PZT is used as target matter, since [that vapor pressure is very high and] the effectiveness of a spatter yield, i.e., a spatter, is high as compared with other Zr, Ti, etc., Pb which is a

configuration element in PZT is very difficult to control the amount of re-spatters, and the amount of reevaporation. That is, since Pb with high spatter yield and vapor pressure is preferentially etched by heating of the re-spatter by Ar ion, a wafer 4, and shielding 8, 9, and 10 (reevaporation), the presentation of the film deposited on the wafer 4 will be changed. For example, when there are many re-spatters in shielding 8, 9, and 10, in order that Pb by which the re-spatter was carried out may carry out wafer 4 HE adhesion from shielding 8, 9, and 10, Pb presentation in wafer 4 film will increase.
[0009] In order to influence [big] wafer 4 periphery by shielding 8, 9, and 10 by the geometry of a wafer 4 and shielding 8, 9, and 10 furthermore as compared with wafer 4 center section, it will have distribution of a presentation in radial [of a wafer 4]. Thus, a target presentation and the film presentation on a wafer 4 are difficult to control in order to be influenced from shielding 8, 9, and 10.

[Translation done.]

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EFFECT OF THE INVENTION

[Effect of the Invention] Since the distance from a wafer is far according to this invention even when the re-spatter of the target matter deposited on shielding by carrying out near of the target inter-electrode distance to a wafer rather than the distance of a wafer and shielding is carried out by the reevaporation and the ion bombardment by heat as explained above, a wafer cannot be reached. Therefore, since the film which grows up to be a wafer becomes only the matter emitted directly from a target, the target presentation itself is imprinted and a deposition film presentation can prevent change of a film presentation of a wafer.
[0043] Moreover, the particle which the normal of the front face of shielding became the structure where the adhesion side of sputtered particles faced outside to a wafer since it is formed so that the wafer periphery section laid in the susceptor may not be turned to, and the re-spatter was carried out among the particles adhering to an adhesion side, or was re-evaporated is not emitted in the direction of a wafer. Thereby, the effect of the re-spatter from shielding and reevaporation can be lost.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The cross-sectional view showing the whole spatter membrane formation equipment configuration concerning 1 operation gestalt of this invention.
[Drawing 2] The cross-sectional view showing the detailed configuration of conventional spatter membrane formation equipment.
[Description of Notations]
1 Vacuum Pump
2 Chamber
3 Cathode
4 Wafer
5 Back Up Plate
6 Target
7 RF Power Source
8 Ground Shielding
9a, 9b Lower shielding
11 24 Cooling water inlet
12 Gas Inlet
21 Susceptor
22 Fin
23 Cooling Water Way

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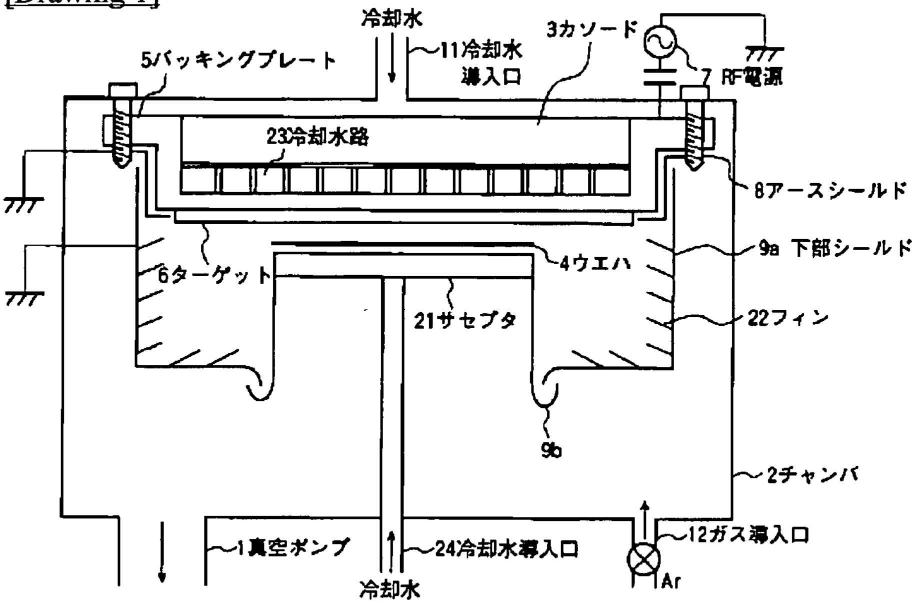
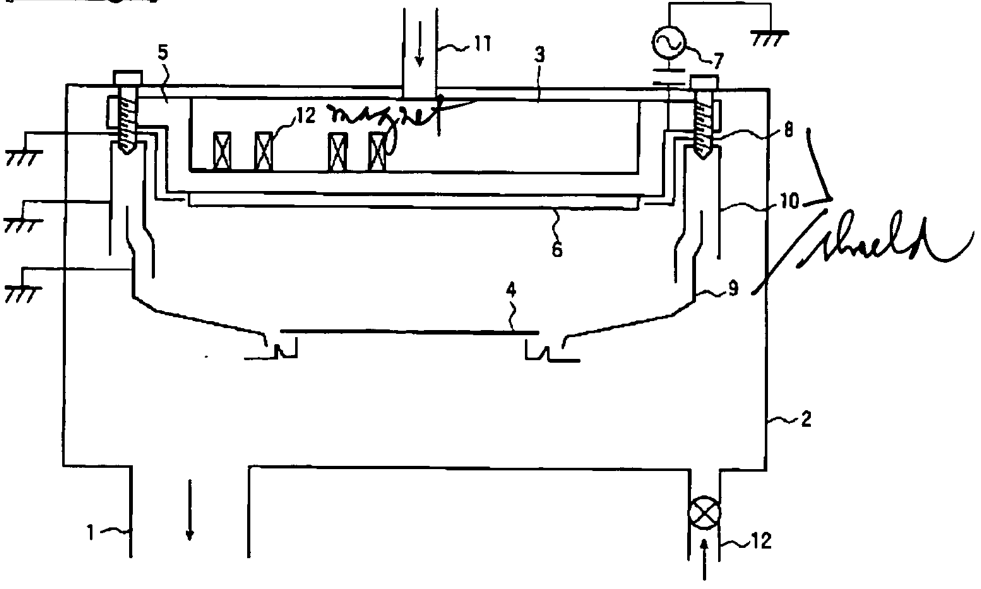
DRAWINGS

[Drawing 1]



[Drawing 2]



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